ENVIRONMENTAL PROTECTION AGENCY

Comments on

DRAFT PHASE II RFI/RI REPORT FOR OPERABLE UNIT 2
May 1995

2 0 TECHNICAL REVIEW COMMENTS

The following comments pertain to each section of the Resource Conservation and Recovery Act (RCRA) facility investigation/remedial investigation (RFI/RI) report where technical inadequacies and inconsistencies were noted Where appropriate, specific comments follow general comments Specific comments are keyed to a particular page, paragraph, subsection, or table Responses to comments are in italics

Section 2 0, Operable Unit 2 (OU 2) Field Investigations

General and specific comments on Section 2 0 are presented below

General Comments

1 Surface soil, subsurface soil, surface water (including seeps), and groundwater (subdivided into upper hydrostratigraphic unit (UHSU) and lower hydrostratigraphic unit (LHSU) samples were collected at OU 2 The data obtained for these media, excluding groundwater, appear to adequately characterize the site Groundwater samples are not adequate for characterization purposes because the data are limited to samples collected from the second quarter of 1991 to the fourth quarter of 1992 The subsurface soil characterization is adequate except for Trench T-13 No source boreholes were drilled into this trench because it was not located until the final OU 2 field work had been completed Although the text explains that the trench likely contains waste similar to that of other nearby trenches, this is a data gap Additional investigations may be necessary to fully characterize the groundwater contamination at OU 2 and subsurface soil contamination at Trench T-13

In April of 1995, an investigation of Trench T-13 was performed as part of the OU 2 Trenches Area and Mound Site Characterization The purpose of the program was to establish the location and extent of the trenches and identify the contaminants within the trenches to support accelerated source removal actions The quality level of the data collected during the characterization activities was Level III and will not be validated Because the data collected is Level III, is not of the same quality level as the data collected for the RI, will not be validated, and will not effect the results of the Human Health Risk Assessment it should not be incorporated into the RFI/RI Report The data collected during the characterization activities shall be analyzed and incorporated into an OU 2 Trenches Area and Mound Site Characterization Report which will be used to support accelerated source removal actions This report will be submitted to the agencies as a separate stand alone document

2 In general, the objective of the bedrock investigation, to characterize the LHSU and to evaluate its interaction with the UHSU appears to have been achieved Detailed lithologic logging, downhole geophysical logging, geotechnical and chemical sampling and analyses, and slug tests were performed These methods assisted in identifying and evaluating the LHSU and also allowed collection of fairly representative LHSU samples

SPECIFIC COMMENTS

Comment 1 Page 2-38. Paragraph 0. The eighth sentence states, "This data set used in the air dispersion modeling analysis is from the more complete data set collected in 1992" The meaning of this sentence is unclear The modeling analyses used 5 years (1989 to 1993) of meteorological data However, the sentence suggests that only the 1992 data set was used in the modeling The sentence should be corrected to properly reflect a 5-year modeling data set

We agree with the comment The referenced sentence in the RFI/RI Report is incorrect Meteorological data used in the air modeling were from 1989 to 1993 as documented in Appendix G The referenced incorrect sentence will be deleted from the RFI/RI Report

Comment 2 Page 2-38. Paragraph 0. The ninth sentence states that "Mixing height data were calculated from twice daily radio sounds from Stapleton International Airport during 1992" Yearly mixing height data must be matched with the corresponding year of on-site meteorological data for use in air dispersion modeling Therefore, 1992 mixing height data must be matched with surface meteorological data from 1992 only If this methodology was followed, the referenced sentence should be changed to indicate that each of the 5 years of meteorological data were matched with the corresponding year of mixing height data from Stapleton International Airport If this methodology was not followed, the meteorological data set should be corrected

The mixing heights for OU 2 were generic mixing heights for Denver Eight mixing heights were used, one for morning and one for afternoon for Winter, Spring, Summer, and Autumn The heights ranged from 163 meters to 3358 meters These values were obtained from "Mixing Heights, Wind Seeds, and Potential for Urban Air Pollution Throughout the Contiguous United States (AP-101), G C Holzworth Research Triangle Park, NC EPA, Office of Air Programs, 1972

FDM is very insensitive to mixing heights, especially when the source is at ground level Informal tests were run by the Rocky Flats Air Programs Group, and no changes were found to occur for changes of mixing height from 163 to 3358 meters

Comment 3 Page 5-74. Paragraph 1. The last bullet item states that modeling was conducted to estimate "impacts at on-site receptors as a result of construction activity concentration concentrations in subsurface soils" It appears that impacts from construction activities were estimated at on-site receptors only and not at off-site receptors Although dust emissions from construction activities are expected to be highest in and around the construction area, dust has the potential to be carried to off-site receptors as well, especially during windy conditions The modeling for off-site receptors should be corrected to include impacts from construction activities

On Table H8-1, "Summary of Estimated Health Risks For AOC No 1," the carcinogenic risk to a Future Construction Worker through the inhalation pathway is 1 3E-07 and the non-carcinogenic hazard index is 1 3E-10 Both of these values are well below acceptable risk levels of 1E-04 to 1E-06 and 1 0, respectively If concentrations of contaminants were transported to an off-site receptor from construction activities, risks to an off-site receptor would be much less than those seen by a construction worker Therefore, since risks to off-site receptors will be acceptable from construction activities, there is no need to change the current air modeling methodology Air modeling to off-site receptors will not be changed

Section 3 0, Physical Characteristics of OU 2

Specific comments on 3 0 are presented below

SPECIFIC COMMENTS

Comment 1 <u>Page 3-38, Paragraph 5</u> Bedrock cross sections (Figures 3 5-25 through 3 5-27) are provided to support the statement, "where closely spaced borehole data exist, various sandstone and siltstone units are shown to pinchout over a distance of several hundred feet or less " Boreholes B315289 and 21393 (Figure 3 5-26) are cited as an example It appears that several of the thinner Laramie Formation sandstones do pinch out between these two boreholes, however, the thickest Laramie Formation sandstone (15 to 25 feet thick) appears to be continuous between the two boreholes A 30-foot-thick sandstone is also found at the same elevation 710 feet south at borehole 21493 This suggests that the thicker Laramie Formation sandstones are laterally continuous over a significant distance, similar to the Arapahoe No 1 sand The cross section shows the sandstone pinching out south of borehole 21493, although there are no data to substantiate this

Similarly, Figure 3 5-25 shows that a Laramie Formation sandstone may be continuous from borehole 21293 to a subcrop location near Woman Creek, a distance of almost 750 feet This sandstone may be capable of providing a lateral pathway to surface water if contaminants were to migrate vertically to the sandstone Therefore, the contaminants were to migrate vertically to the sandstone Therefore, the contention that Laramie Formation sandstones are discontinuous beyond distances of several hundred feet is not supported by the referenced figures and should be removed from the text

The rock classifications that have been assigned to the bedrock are based upon sieve analysis, where the rock type is determined by the constituent having the highest percent, the primary modifier the next highest percent, and the secondary modifiers the lower percentages of the overall composition of the stratigraphic member In the case of the comparison of the unit between boreholes B315289 and 21393 on Figure 3 5-26, the unit is shown as a sandstone Referring to lithologic symbols shown on the stick logs of the holes it should be noted that the unit in hole

B315289 is predominately a silty sandstone, with an interbedded sandstone, while the unit in 21393 is a clayey sandstone over the entire length of the unit In the case of 21392 the sand fraction of the unit is less than 45% of the total rock, while the clay constituent is nearly as high as the sand fraction (taken from the lithologic log of the hole) A minor percentage of silt makes up the remainder of the unit A slight decrease in the sand fraction would change the rock type to sandy claystone Both will have the same hydraulic conductivity because the pore space is entirely filled with clay and silt sized particles

As mentioned in the comments, the unit shown in holes B315289 and 21393 may correlate with the sandstone member shown at a depth of 67 to 97 feet in hole 21493 The lithology log of this hole indicates that this unit consists of interbedded silty sandstones and clayey sandstones This further indicates that there can be lateral facies changes within a correlatable stratigraphic member

Hole B315289 is probably less permeable than indicated because the sieve analysis were conducted under less than ideal conditions (before core logging facilities were available) Because the samples are completely broken down before accurate analysis can be obtained, it is likely that the unit was probably higher in clay than was indicated on the core log Overall it is facies changes do occur over short distances and because of the scale of the cross sections all data cannot be shown

In the case of the sandstone unit being projected from hole 21293 to Woman Creek, on section 3 5-25, the implied projection is qualified with a lot of question marks The best comparison can be made by lining up hole 21293 on this section, with hole 21493 on section 3 5-26 Hole 21493 lies approximately 580 feet to the southeast of hole 21293, and is the closest control with respect to determining the lateral extent of the stratigraphic unit in question It can be observed that this unit correlates well with a clayey siltstone (also from the lith log of that hole) at the same elevation It appears that the same characteristic facies change also exist at this elevation

As already mentioned the sandstone unit shown in hole 21493, at a depth of approximately 67 feet to 97 feet, consist of interbedded clayey sandstones and silty sandstones Because it already consists of a series of thinner beds, and there is a lack of control further to the south, it is logical to assume that the same characteristic lateral facies changes will exist here as in locations with closer control, and not to extend the unit further to the south

Comment 2 Page 3-48, Paragraph 1. Section 3 6 3, which is supposed to contain a discussion on the hydrogeology of subcropping Laramie Formation sandstones, is missing from the document This missing section was also noted in comments on the preliminary draft RFI/RI report (PRC 1994)

The comment is correct The reference to Section 3 6 3 will be changed to Section 3 6 2 3 The detailed discussion about the subcropping Laramie Formation sandstones is in the third paragraph on page 3-67

Section 4 0, Nature and Extent of Contamination

General comments on Section 4 0 are presented below

GENERAL COMMENTS

1 The nature and extent of contamination discussion in the preliminary draft RFI/RI report used a different set of screening criteria (waste-related, volatile organic compound (VOC) chemical of concern (COC) and chemical of interest (COI) to determine which contaminants would be included in the discussion of each medium investigated The draft final RFI/RI report eliminated the inconsistent data presentation The text now discusses the potential chemicals of concern (PCOCs) in every medium analyzed The title of the section was also changed to "Nature and Extent of Potential Contamination " The text explains the process of PCOC selection This consistent data presentation approach creates a thorough and comprehensive discussion of the nature and extent of contamination at OU 2

2 Although the discussions on each medium focus on the PCOCs identified for that medium, the accompanying figures illustrate only the organic PCOCs and those inorganic PCOCs that exceed the background screening level (BSL) The BSL is the mean of the background data set for each analyte plus two standard deviations Therefore, the figures do not illustrate all the PCOCs at OU 2

The figures and plates in Section 4 0 illustrate all VOC detections, which by definition are PCOCs However, only the inorganic PCOCs detected at concentrations that exceeded the background screening level (BSL) are discussed and illustrated This approach, which screens out those metals and radionuclides present at background concentrations, was necessary for the selection of source areas At a meeting held at the EPA on June 7, 1994, it was agreed that this approach was also acceptable for use in the RFI/RI report

3 Minor errors were found with approximately 30 percent of the tables, text, and figures checked These errors include, inconsistent reporting of chemical concentrations, chemicals illustrated on figures but not discussed in the text, inaccurate labeling of data points, incomplete or improper citations of supporting documentation, and incomplete labeling of data qualifiers The tables, text, and figures should be carefully checked and corrected

The tables, text, and figures will be reviewed and revised, if necessary, to correct identified errors However, a list of the specific errors found should be provided to allow for an accurate and thorough review of the tables, text, and figures in question

4 Section 4 1 6 briefly describes the COC selection process outlined in Appendix H, and indicates that professional judgment, geochemical evaluations, and/or additional statistical analysis, as appropriate were applied to eliminate some analytes as PCOCs This indicates that only those chemicals identified as PCOCs were used in the COC selection process, which is inappropriate Using a mechanism to screen contaminants identified in site samples so that the presentation of data is uniform and readable is fine However, applying the nature and extent of contamination screening methodology to eliminate detected chemicals from the COC selection process is not acceptable All detected chemicals should be entered in the COC selection process Please refer to comments 1 and 2 on the HHRA of this report, for further discussion of problems noted in the COC selection process

On October 7, 1994, the Environmental Protection Agency (EPA) approved the list of Chemicals of Concern (COC) used in the risk assessment by approving the COC technical memorandum The process used to select COCs included professional judgement, geochemical evaluation and statistical analyses This reviewed and approved list of COCs was used in the human health risk assessment

5 Only subsurface soil data pertaining to soils above the water table were evaluated in this RFI/RI report because of concerns that subsurface soil analytical results are impacted by groundwater contamination (page 4-7, first paragraph) Although subsurface soil results are impacted by groundwater contamination, data on subsurface soils below the water table are useful in evaluating adsorption of groundwater contaminants to soil and the effectiveness of any future groundwater remediation Also, subsurface soil contamination, even as a result of migrating groundwater contaminants, may serve as a groundwater contaminant source in the future Therefore, data on soils below the water table are useful Further these data were collected and are available, and should be included and evaluated in this RFI/RI report

The statement, "Only subsurface soil data pertaining to soils above the water table were evaluated in this RFI/RI report " is incorrect All available subsurface soil data, above and below the seasonal high groundwater level, were used in the evaluation of the nature and extent of contamination For example, the reviewer is referred to page 4-53, paragraph 2 (Summary) However, only subsurface soil data above the water table were used in the background comparison for the reason mentioned The text will be amended to clarify this point

6 The text of Section 4 2 states that Section 4 1 5 3 contains a discussion of the source areas, however, there is no Section 4 1 5 3 in the report This discrepancy should be corrected

The comment is correct The reference to Section 4 1 5 3 will be changed to reference Section 4 1 5

7 Section 4 3 2 1 includes a discussion of radionuclide detections exceeding BSLs The text states that U-238 was infrequently detected at activity concentrations only slightly above BSLs However, Table 4 3-7 shows that U-238 was detected at a concentration of 2 95 picoCuries per gram (pCi/g), which is approximately double the BSL concentration of 1 485 pCi/g This discrepancy should be resolved

The text will be revised to "Pu-239/240 and U-238 were infrequently detected, but elevated activities of 0 122 pCi/g and 2 95 pCi/g respectively, were detected at a depth of 2 to 8 feet BGS from borehole 07991 "

8 The characterization of the nature and extent of contamination is based on a restricted number of samples collected between second quarter 1991 and fourth quarter 1992 Thus, the conclusions presented in this section are already dated For instance, in Section 4 4 2 5 it states that all VOCs in groundwater in the area east of OU 2 individual hazardous substance sites (IHSSs) were detected at concentrations less than 10

micrograms per liter (µg/L) However, data recently retrieved from the U S EPA Rocky Flats Data Retrieval Process (RFDRP) show a maximum trichloroethane (TCE) concentration of 418 µg/L and a maximum carbon tetrachloride concentration of 2,292 µg/L in groundwater samples from well 3986, which is east of the OU 2 IHSSs Plates 4 4 1 and 4 4 2 depict this well as being free of any contamination Contaminants have apparently moved into this well since the end of 1992, indicating either a source or pathway that has not been accounted for in the RI Only data that were available at the time the report was written can be included, but it is misleading for a document dated May 1995 to be only as current as December 1992 The report should include new information because of the long (1-1/2-years) period between draft and draft final versions of the document

The data set used for the OU2 Phase II RFI/RI Report includes all data available through fourth quarter 1992 This same data set was used in preparing several technical memorandums and reports for the agencies, all of which have been approved with minor comments The gap of approximately two years between the draft and draft final Report is due to the stop work order issued by the Regulatory Agencies after the submittal of the draft RFI/RI Any data collected after 1992 has been and will continue to be reported in the Annual Monitoring Reports for groundwater and surface water as well as the annual Environmental Report which are submitted to the agencies Any further reporting and analysis of the data will be performed in conjunction with remediation activities All available data will be used to support Proposed Action Memorandums (PAMs), Interim Measure /Interim Remedial Actions (IM/IRAs), and Records of Decision (ROD) documents which will also be submitted to the Agencies for approval prior to remediation or closure activities

The groundwater model for OU2 does take into account mobility and pathways for contaminant migration The existing data set includes all data through 1992, and is more than adequate to characterize the current nature and extent of contamination within OU2 and model for future trends Changing the data set used for the RFI/RI Report would not significantly change the conclusions of the report, but would require a significant effort to revise all calculations, tables, and figures which would be affected by the additional data

Section 5 0, Fate and Transport of Chemicals of Concern

General comments on Section 5 0 are presented below

GENERAL COMMENTS

1 This section has not been reorganized since submittal of the preliminary draft OU 2 RFI/RI Subsections 5 1 and 5 2 present a general discussion of the physical and chemical factors that determine the fate and transport of COCs at OU 2 This section uses site-specific examples frequently and is an adequate summary of the geochemistry of COCs at OU 2 Section 5 3 presents conceptual models showing contaminant migration pathways for each of the five subareas of OU 2 Subsection 5 4 presents the approach and results of groundwater, surface water, and air modeling The modeling efforts were

designed only to support the HHRA and not to support a possible future feasibility study, which may require additional modeling Numerous specific comments on Appendixes E and F address problems with the modeling efforts

Section 6 0, Human Health Risk Assessment

Section 6 summarizes the HHRA for RFETS OU 2, and accurately reflects the information in Appendix H, which contains the entire HHRA Therefore, comments are not offered for Section 6 Instead, Section 6 should be revised as appropriate based on the review of Appendix H

Any changes to Appendix H will be included in this section

Section 7 0, Conclusions and Recommendations

General comments on Section 7 0 are presented below

GENERAL COMMENTS

1 The RFI/RI concludes that environmental contamination within OU 2 does not pose a threat to public health under the evaluated exposure scenarios and that remediation is not warranted (based on public health risk levels only) The report then states that it may be appropriate to remove or immobilize materials in the IHSSs that are acting as continuing sources of groundwater and soil contamination to limit ongoing environmental effects from OU 2 contamination Before this conclusion can be given significant consideration, human health risks associated with these removal actions should be evaluated and compared to baseline risk levels In addition, ecological risks associated with both no-action and source removal must also be evaluated and compared before removal is given serious consideration

Although the Human Health Risk Assessment shows OU 2 does not pose a significant risk to public health, it is believed the contaminants in the trenches and other Individual Hazardous Substance Sites (IHSSs) are a source to groundwater contamination Thus it will be necessary to further characterize some of the IHSSs to determine if accelerated source removal actions are necessary to mitigate spread of further contamination to subsurface soil and groundwater These investigations will also provide useful information for worker protection during remediation activities

The text of Section 7 0, Conclusions and Recommendations of the RFI/RI Report shall be revised to summarize the findings of the report not to make decisions on remedies for OU 2 Comments regarding additional investigations and remedies shall be deleted from the text

2 The report states than an adequate understanding of the location and dimensions of high concentrations within the IHSS would be necessary before sources can be removed It states that additional focused investigations are needed to calculate reliable estimates of the volumes of material that are continual sources of contamination The report proposes characterizing chemical and activity concentrations in high-concentration areas as well as identifying the locations and dimensions of trenches and high-concentration areas In addition, it is not clear whether this information will be used to evaluate the feasibility of excavating contaminant sources If removal is justified without this information, the

purpose for obtaining this information should be further explained since boundaries and chemical concentrations of the high-concentration areas will be discovered during the removal action

Additional characterization of the IHSSs within OU 2 shall provide additional information which will assist in determining volumes of contaminated material to be treated, the extent of contaminated areas to be remediated, potential health risks to workers and the environment, and the feasibility of source removal actions Future removal actions and remediation plans will take into consideration potential discovery of source contamination and risks associated with the contamination These plans will be reviewed prior to implementation

Text pertaining to future investigational requirements and source removal shall be deleted Any further characterization of OU 2 shall be used to support the Feasibility Study process and accelerated source removal actions

3 The conclusions in the report regarding removal actions are premature without first evaluating applicable or relevant and appropriate requirements (ARARs) and ecological risks from OU 2 contamination If ecological risks, including those resulting from OU 2-contaminated groundwater seeping into Woman Creek and South Walnut Creek, are negligible, and ARARs do not dictate groundwater remediation, removal may not be warranted Containment measures may be more feasible when health risks and costs associated with removal are considered

Comments regarding source removal actions shall be deleted from the text Plans for remediation and removal actions shall take into consideration applicable or relevant and appropriate requirements (ARARs), and risks to human health and the environment from OU 2 contamination These plans will be reviewed prior to implementation

Appendix E Groundwater Flow and Contaminant Transport Models

General and specific comments on appendix E are presented below

GENERAL COMMENTS

1 The MODFLOW numerical groundwater flow and MT3D contaminant transport models were used to evaluate the UHSU groundwater flow system at OU 2 in support of the OU 2 HHRA Specifically, the models were used to generate a contaminant source term to input into the colluvial fate and transport model The colluvial fate and transport model was then used to generate a source term to input to the surface water fate and transport model was then used to generate a source term to input to the surface water fate and transport model, which is use to estimate 30-year average contaminant concentrations at downstream receptor locations (in Woman and Walnut Creeks at Indiana Street) The model report and results appear to remain unchanged from those presented in the preliminary draft RFI/RI report (EG&G 1994)

The MODFLOW model represents two flow systems, the Rocky Flats alluvium (RFA) and Arapahoe Formation number 1 sandstone (No 1 Sand), as a single unit even though the hydrogeologic characteristics and flow directions in the two systems appear to differ greatly The model, therefore, does not accurately represent the physical system, creating a high degree of uncertainty in the model results, particularly regarding the contaminant mass that exists the model at the seeps Specific problems with the groundwater flow model are summarized below These problems are also discussed in more detail in comments on the preliminary draft RFI/RI report (PRC 1994)

- The process of creating a composite water table (between the RFA and No 1 Sand) has resulted in a flow field that is a poor representation of likely flow directions in the individual units in areas where flow directions between the two units diverge This problem is particularly acute adjacent to the northern boundary seep locations, where the mass load to the colluvial model is calculated

- The one-layer model does not account for the resistance to vertical flow that may occur when Arapahoe claystones subcrop below the RFA Claystones are simply subtracted out of the total aquifer thickness rather than being represented numerically with a low interlayer (vertical) conductance term Therefore, the conductance of recharge to bedrock sandstones will be uniform regardless of whether sandstones subcrop directly below the RFA, or if sandstones are separated from the RFA by many feet of claystone

- The calibrated hydraulic conductivity arrays are not consistent with the characterization of OU 2 hydrogeology in the RFI/RI report High hydraulic conductivity zones do not correspond to either the RFA paleochannel or the distribution of sandstones in the Arapahoe Formation Figures for both the high and low recharge scenarios show three isolated regions of high hydraulic conductivity at the west boundary, in the center of the model, and at the northeast corner Maps and cross sections included with the main body of the RFI/RI report show both the alluvial paleochannel and No 1 Sand to be continuous from the center of the model to the northeast corner

The two-layer groundwater flow model provided in the Corrective Measures Study/Feasibility Study (CMS/FS) Groundwater Flow Modeling Report for OU 2 (DOE 1995) is considered much more representative of the physical structure and processes at OU 2 and should be used in place of the simplified model provided in the draft final RFI/RI report This substitution would result in greater consistency between the RI and FS portions of the investigation Although it would require rerunning the subsequent models (colluvial and surface water), it would not require adjustment of the meteorological data set that drives the surface water model

The simplified groundwater flow model developed for the RFI/RI Human Health Risk Assessment was constructed to provide a conservative estimate of contaminant mass loading to the adjacent surface water systems within the schedule constraints of the RFI/RI report Although this technique provides only a basic representation of the OU 2 hydrogeology, it provides a conservative estimate of contaminant mass loading which is appropriate for the HHRA scenarios under consideration The concept of the single-layer, simplified model was presented to, and approved by the reviewing agencies prior to its implementation

As explained on Page E3-4 of the report, the composite water table contours were *adjusted within the area of the northern bedrock paleoridge to avoid overestimation of groundwater discharge in this area Because of the conservative assumptions used in developing this model, it is believed that these contour adjustments will not affect the modeling results in a manner that will underestimate the risk to human health*

The development of the simplified model required the adoption of a single layer model domain This precludes the incorporation of inter-layer flow vertical conductance terms This simplification is not considered to significantly affect the modeling results in a manner that will underestimate the risk to human health

The simulation of a generalized hydrogeologic system calibrated to composite groundwater table elevations results in a hydraulic conductivity array which is also generalized The hydraulic conductivity array resulting from the simplified model calibration represents values of hydraulic conductivity for the composite flow system which incorporates the Rocky Flats Alluvium, subcropping sandstones, and interbedded claystone layer This simplification of the flow system, and the heterogeneity of the individual hydrogeologic units, complicates interpretation of the hydraulic conductivity array using the subsurface geology

The simplified model used in the RFI/RI meets the needs for the HHRA by providing conservative estimates of contaminant loading to the adjacent surface water systems The additional level of detail provided by the CMS/FS model is not required for this purpose

2 The discussion of the colluvium fate and transport model in Section E6 does not specify the duration of transport through the colluvium Transport distance through the colluvium could be very short for contaminants on the north side of the model, particularly where bedrock seeps are located on the edge of Ponds B-1 and B-2 The assumed duration of contaminant transport through the colluvium should be provided

The pore velocities and flow distances for the colluvial transport model are provided on pages E6-3 and E6-4 of the reviewed report

SPECIFIC COMMENTS

Comment 1 Section E6.3. Page E6-6. Paragraph 1. Abandonment of the conservative approach to allocating space source concentrations in the RFA for MT3D model when assigning a source concentration for Trench T-2 in the colluvial model is not sufficiently explained The MT3D source locations were assigned the highest observed dissolved-phase concentrations to the entire source cell, the Trench T-2 source term is a length-weighted average source concentration The length-weighted average source term for TCE is 3,066 µg/L, whereas the highest concentration of TCE detected at Trench T-2 from second quarter 1991 through fourth quarter 1992 is 150,000 µg/L The text states that the length-weighted source term is based on the assumptions that saturated flow occurs in the colluvium from the seeps to the creek and that flow conditions are uniform This is unclear and should be further explained

Agreed Additional explanation will be added

Comment 2 Table E6.3 The units given for annual activity of americium-241 should be changed from picoCuries per liter (pCi/L) to Curies per liter (Ci/L) to be consistent with the plutonium-239/240 column The correct value would be 4 5E-08 Ci/L

Agreed This table will be corrected to provide consistent units

Appendix F, Surface Water Modeling

General comments on Appendix F are presented below

GENERAL COMMENTS

1 A surface water fate and transport model was developed for the Walnut Creek and Woman Creek drainages at RFETS to support the HHRA portion of the OU 2 RFI/RI The model is intended to be a screening-level model that can be used to estimate long-term (30-year) average concentrations of VOCs and radionuclides in Woman and Walnut Creeks at the eastern RFETS boundary The model was designed to include event-specific runoff and loading to provide realistic estimates of contaminant loading based on site-specific and event-specific data

The modeling approach is generally sufficient for the stated purpose The primary fate mechanism modeled within the stream is volatilization of VOCs However, some oversimplifications of the physical system were incorporated that may preclude the model from being as useful as would be desired The most significant assumption is that the model ignores the effects of engineered structures (ponds, diversion ditches, treatment systems) on contaminant transport In addition, sedimentation and resuspension in the stream channels was ignored Such an approach has the effect of simulating contaminant transport through a concrete-lined ditch with no deposition or resuspension This approach is likely to be appropriate for VOC contaminants that are not heavily sorbed to particulates in the streams but it is not appropriate for radionuclides that are primarily associated with particulates Significant portions of the suspended sediments are expected to be deposited in the ponds

The authors state that the approach taken will overpredict COC concentrations because the existing engineered structures deter contaminants from migrating to Indiana Street This is true for storms where overland flow introduces eroded sediment into the streams However, many of the storms reportedly do not produce overland flow In this case, resuspension of stream sediments will increase suspended solid (and probably radionuclide) concentrations above those predicted by the model

The second assumption states that only contaminant loads from OU 2 were included in the model although hydrologic input from the entire Walnut and Woman Creek watersheds was included This assumption has the following implications

1 The source of sediment is smaller than the actual watershed

2 The soil delivery ratio (S_d) is a calibration parameter The calibrated value of

0 24 overestimates the erosion of soils between the two creeks since no soil is eroded from outside of OU 2

3 The overestimation of soil erosion in OU 2 has serious implications regarding radionuclide concentrations in the creeks Radionuclide concentrations are likely overestimated because soils in OU 2 may have higher concentrations of these COCs than the soils in the remainder of the Woman and Walnut Creek watersheds

It is recommended that sedimentation terms be added to the transport model to account for sedimentation in the ponds If data are available, sedimentation and resuspension should also be included in the stream channels It is also recommended that loading terms for the portions of the drainage outside the drainage area be included in the model

As stated, the model was developed as a screening level model to estimate long term (30 year) ***average*** *concentrations of VOCs and radionuclides at the eastern RFETS boundary Given the scope of HHRA requirements, sedimentation/resuspension of stream sediments and the existing engineered structures were not included in the model It is true radionuclide concentrations are likely over-estimated in Woman and Walnut Creeks due to these simplifications, and they provide a conservative estimate of potential risk*

The statement that the model does not simulate increased TSS (and therefore radionuclide concentrations) during "non-overland flow events" is correct It is also correct that most precipitation events at RFETS do not produce overland flow However, these events are relatively insignificant when calculating the ***average (mean)*** *concentrations for the next 30 years, as used by the HHRA Surface water sampling results, and subsequent modeling analysis, show a greater than 1 order magnitude difference between* ***mean*** *and* ***median*** *concentration values This statistic indicates, that though the model does not simulate the "small" stream sediment resuspension events, the mean concentration values depend upon the "large overland flow events Inclusion of a stream sedimentation and resuspension routine would not significantly alter the predicted mean values Please refer to table F7 2-1 in the OU 2 Phase II RFI/RI report for sample mean and median values*

Appendix H, Baseline Health Risk Assessment

The baseline health risk assessment was not included in the preliminary draft phase II RFI/RI report Therefore, a more detailed review containing both general and specific comments is provided in this section

GENERAL COMMENTS

1 The text indicates that the COCs evaluated in the HHRA were selected as described in the May 1994 draft final Technical Memorandum 9 The version accepted by EPA was from August 1994 with the addition of several groundwater COCs as noted in a letter dated October 1994 from EPA to DOE It appears that the COCs evaluated in the RI are those approved by EPA However, the citation should be corrected

The text will be changed to include the correct citation

2 Several parameters used in the exposure calculations should not be used because there is

insufficient information and they could cause the estimated intakes of COCs to be significantly underestimated Exposure parameters, which should not be used include the fraction contaminated (FC), matrix effect (ME), particulate deposition factor (DF), wash-off factor (WO), and a weighting factor

The FC was used to estimate the amount of contaminated medium (soil or groundwater) that a receptor would contact relative to uncontaminated media In some cases, the FC was set equal to 1, indicating that the receptor would contact soil or groundwater only at OU 2 However, for other receptors, this value ranged from 0 15 to 0 9 for both central tendency (CT) and reasonable maximum exposure (RME) estimates, which decreases exposure estimates by 10 to 85 percent The use of this factor, particularly for the RME estimates, should be fully justified The adjustment of exposure frequency, duration, and intake rate parameters accounts for exposures that occur less than 100 percent of the exposure time Therefore, the FC factor is unnecessary Additionally, the adjustments can only be made based on site-specific knowledge about the receptor and receptor behavior patterns Any further adjustments in the form of a FC is not acceptable

Specifically, the RME FC value of 0 5 was used to assess dermal contact with soil for the open space user In a letter to DOE dated April 11, 1995, EPA specifically requested that a value of 1 0, and not 0 5, be used for FC in evaluating RME recreational risks and hazards However, the CT values for FC appear to have been appropriately applied

The ME factor was used to account for decreased dermal absorption of COCs in soil because of adsorption of the chemical to the soil matrix In general, adsorption of a chemical to soil particles decreases its bioavailability The text further explains the selection of the ME variable However, before using an ME factor, the soil type on which the ME is based should be compared to site-specific soil conditions If soil types are dissimilar, then the ME cannot be used in estimating intakes The ME, like the FC factor, causes a decrease in the estimated intake Additionally, EPA has previously requested that ME factors be submitted for approval prior to use in the risk assessment Until there is EPA concurrence, the ME factor should not be used in the exposure equation and no adjustments should be made for bioavailability

The DF factor is used to estimate the amount of inhaled particulate that is deposited in the lungs In general, a DF may be used to represent the amount of respirable contaminated particulate matter (PM_{10}) that is present in air, but it should not be used to decrease the exposure concentration if the concentrations in air already represent the PM_{10} fraction As stated in EPA guidance (1989), "Derive inhalation estimates using the particulate concentration in air, the fraction of the particulate that is respirable (i e , particulates 10 μm (micrometers) or less in size) and the concentration of the chemical in the respirable fraction " Use of a DF will decrease the estimated intake Furthermore, if it is assumed that only a percentage of the particulates will deposit in the lungs, the remaining percentage will either be swallowed or expectorated The ingestion equation should then be revised to account for the portion of inhaled particulates that is swallowed It would be more appropriate, however to eliminate this factor from the RME inhalation equation for all receptors, as was stated by EPA in the April 11, 1995 letter and in previous discussions between EPA and DOE

The WO factor should not be used This factor is intended to represent the amount of particulate matter that is washed off of homegrown produce before it is consumed Although this factor was used only for estimating CT risks, it was based on incorrect information This value was proposed wit the understanding that it had been used at the Rocky Mountain Arsenal In fact, this parameter was not used The WO factor should not be used to assess exposure to contaminants on homegrown produce

Finally, a weighting factor has been included in the exposure estimates This factor is described in the text as that fraction of the day that a current occupational worker would spend in OU 2 According to the text, "the factor is derived by dividing the area of OU 2 by the total area of the RFETS property 1,000 acres/6,550 acres=0 17 (equivalent to about 1 1/2 hours based on an 8-hour workday) " Again, this factor decreases the intake factor and, therefore, the risk estimate The weighting factor may be used for CT estimates, but was not accepted by EPA for the RME estimates To account for the less-than-default exposure frequency of the RME current occupational receptor, the exposure frequency should be adjusted without use of a weighting factor Using the proposed weighting factor results in an exposure frequency of approximately 43 days per year If a concern exists that a worker may contact "clean" media along with "contaminated" media, the exposure unit and exposure point concentration should be redefined to account for such exposures A risk assessment framework already exists for incorporating more plausible assumptions into the exposure assessment, and deviations from default assumptions should be made within this framework

In Attachment H2, "Exposure Factors Tables," all the FC or Fraction Contacted values are equal to 1 0 in the Reasonable Maximum Exposure case for all exposure scenarios except the open space exposure scenario EPA directed this approach in a letter dated April 11, 1995 Per the body of the letter, all FC parameters were changed to 1 0 for the Reasonable Maximum Exposure scenario Per the attachment to the EPA letter, contact with soil should be multiplied by 50% for the open space scenario Therefore, a FC value of 0 5 for dermal contact was used in the risk assessment

Section H6 2 1, "Soil Ingestion," outlines the rationale for using specific Matrix Effect values for soils This rationale is conservative in that all matrix effect factors are high given the literature findings Where a matrix effect could not be justified, a matrix effect of 1 0 was used This conservative approach should take into account different soil types

The basis for the use of the Respiratory Deposition Factor (RDF) was reviewed Since the PM10 fraction was also used in the inhalation equation, the RDF will be dropped from further calculations for conservatism Inhalation risks were based on the PM10 fraction of suspended particulate matter This change will increase the inhalation risk by approximately 10% This will not change the acceptability of the risk assessment results

EPAs <u>Transuranium Elements, Volume 2, Technical Basis For Remedial Actions</u>, (EPA 520/1-90-016) uses a 90% washoff factor for leafy vegetables and a 99% washoff factor for other food plants These values seem reasonable since most people wash and/or peel fruits and vegetables before consuming them For conservatism, no washoff factor was used for RME exposures and a 50% washoff factor was used for CT exposures in the OU 2 risk assessment The washoff factor used in the OU 2 risk assessment will not be changed

The weighting factor was incorporated into the current on-site industrial worker exposure scenario (Security Inspector) to account for the fact that current workers are not constantly present in the OU 2 area Since a security inspector tours the whole site, an area weighting factor was applied to this exposure scenario to take into account the fraction of time spent in OU 2 by the security inspector An equivalent procedure would have been to decrease the annual exposure frequency of the security inspector The risk assessment will not change from one procedure to the other Since the exposure factors in Attachment H2, "Exposure Factor Tables," are to be used across all OUs, it is more efficient to keep the exposure frequency of 250 days/year for the security inspector and apply the weighting factor by OU In order to apply exposure factors efficiently across the whole site, the weighting factor will be used in the risk assessment

3 Some of the exposure parameters used to estimate risk are not standard and their use should be explained Such parameters include

- CT exposure duration for occupational workers (4 years instead of 5 years)
- CT inhalation rates (0 63 cubic meters per hour (m^3/hr) instead of 0 83 m^3/hr)
- CT and RME parameters for ecological researchers and recreational receptors
  - Open space receptor, central tendency

    soil ingestion rate, child (15 mg/day instead of 50 mg/day)
    soil ingestion rate, adult (8mg/day instead of 25 mg/day)
  - Ecological worker

    RME dermal surface area (4700 square centimeters (cm^2) instead of 5,300 cm^2)
    Exposure frequency (65 days per year instead of 242 days per year)
    Exposure duration (2 5 years instead of 19 years)
  - Future resident

    RME dermal surface area, for surface water (18,150 cm^2 instead of 19,400 cm^2)

For CT exposure parameters, the Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure (EPA 1993) should be consulted For ecological researchers, exposure parameters that are representative of exposures for the RFETS area have ben provided in the Rocky Flats Plant Final Human Health Risk Assessment Template (EPA 1994) The exposure parameter values in the template should be used to estimate RME risks to ecological workers For recreational receptors, EPA-suggested exposure parameters were submitted to DOE in a letter dated April 11, 1995

The basis and/or derivation of all exposure factors is given in the footnote to the exposure factor The level of explanation given for the exposure factors listed by the reviewer is *equivalent to the level of explanation provided for many other exposure factors*

4 A radiological dose assessment was prepared as part of the OU 2 HHRA A dose assessment is required as part of the HHRA (EPA 1994) but some issues should be addressed prior before the results can be accepted

For on-site exposure, the appropriate limit to use is that of "minors, visitors, and members of the public," which is 100 millirem/year (mrems/yr) Workers are required to be monitored if they are likely to receive more than this dose Therefore, a requirement in 10 CFR 835 would be violated if nonradiological workers would likely receive more than 100 mrems/yr total effective dose equivalent (TEDE) from sources in the soil With this limit in mind, 100 mrems/year (or the 15 mrems/yr explained below) should be the dose limit used as the health protective benchmark, not 5,000 mrems/yr

Cleanup scenarios are now generally geared toward a TEDE of 15 mrems/yr for the maximally exposed individual This is the limit that the Nuclear Regulatory Commission (NRC) has adopted in its draft "Radiological Criteria for Decommissioning " This may now be, or soon will be, in final form The EPA has signed a memorandum of understanding with NRC and is working together with NRC to develop this rule This rule is expected to be adopted for all radiological cleanup work the two agencies regulate Furthermore, 15 mrems/yr correlates to a risk value slightly greater than 1E-4, which means that 100 mrems/year is equivalent to a risk of nearly 1E-3, which is in excess of the acceptable risk level for chemicals In addition, the slope factors that EPA uses for radiological risk are based on BEIR III results The current guidance document on radiological risk is BEIR V, which is more restrictive on dose that is BEIR III

Furthermore, dose assessment does not address the effects of radium and its progeny Depending on the source terms, radium can be a major contributor to dose, especially over a 30-year exposure duration As the radioactive material shown on Table H9-1 decays, radon will be generated The upward movement of radon through the vadose zone could create a health hazard via inhalation Radon that permeates buildings can be concentrated and pose an even greater health hazard However, the potential effects of radon-222 (a daughter product of the uranium-238 decay series) should be evaluated only after it has been determined that the uranium series is at secular equilibrium

In addition, units of rem and rad are the accepted standards for radiological units of dose equivalent and absorbed dose, not units of seivert and gray used in the document However, use of the seivert and gray units does not change the results of the dose assessment

Section H9 1 3 states that there are two radiation dose limits for general employees depending on the employees circumstances These dose limits are 100 or 5000 millirem per year The text does not state which is more appropriate It is agreed though that the 100 millirem per year radiation dose limit is the most appropriate limit for members of the public

DOE Order 5400 5 states that doses to members of the public will be kept below 100 millirem per year Nuclear Regulatory Commission standards are not recognized by the

Department of Energy in this case since DOE Order 5400 5 is in use at the Rocky Flats Environmental Technology Site

Radium is not one of the reviewed and approved Chemicals of Concern at Operable Unit 2 so it was not assessed in the radiation dose assessment Also, the units of rem and rad have been superseded by the units of seivert and gray, respectively, due to the use of the international system of units for radiation protection Both types of units can be used however since results do not change with differing units

SPECIFIC COMMENTS

Comment 1 Page H4-8, Section H4.4.1. This section describes sitewide incomplete or negligible pathways that were not further evaluated in the risk assessment Included in this description are ingestion of homegrown beef products and ingestion of fish Although ingestion of beef products is likely to be an incomplete pathway for on-site receptors, off-site agricultural land use in possible This pathway should be classified as plausible but negligible because Table H4-1 indicates that future off-site agricultural land use is a credible future land use, and the text states that cattle are grazed in areas near RFETS

Ingestion of fish from Woman and Walnut Creeks is also considered an incomplete pathway The template (EPA 1994) has identified this pathway as potentially complete for occasional exposure Ingestion of fish from the area has never been characterized as subsistence fishing, but future recreational activities may include fishing This pathway should be evaluated for open space users and off-site residents

The beef ingestion pathway is classified as negligible for all receptors, it is not classified as incomplete for all receptors

Ingestion of fish in Woman and Walnut Creek is considered incomplete since fish should not be present in the creeks due to their intermittent nature Therefore, fishing would be unproductive in the future at Woman and Walnut Creek This pathway will not be evaluated

Comment 2 Page H4-11, Last Paragraph. This paragraph states the off-site external exposure to radionuclides was not evaluated because it was considered a negligible pathway and because off-site radionuclide concentrations in soil are below health-based protective levels While this may be true, off-site transport of and exposure to radionuclides is a major public concern, and exposure to airborne radionuclides (which then deposit on surface soil) is a complete pathway This pathway should be quantitatively evaluated in the HHRA, this will also be useful as a comparison to risks associated with any planned remediation which would increase airborne radionuclide concentrations (and, therefore, deposition of radionuclides on off-site surface soil)

It is understood that the off-site transport of and exposure to radionuclides is a public concern This is why the most significant contributors to risk were included in the assessment of the off-site receptor The pathways of soil ingestion, soil *inhalation, dermal contact with surface soil and ingestion of fruits/vegetables were assessed for the off-site residential receptor*

To understand the contribution of external irradiation to the off-site receptor, a comparison between soil ingestion and external irradiation can be made for the hypothetical on-site resident for Area of Concern No 1 in Attachment H3, "Health Risk Calculations " The carcinogenic risk from direct soil ingestion using the Reasonable Maximum Exposure (RME) parameters is 2 45E-04 for Pu-239/240 and Am-241 combined The carcinogenic risk from external irradiation using the same RME parameters is 3 68E-06 for Pu-239/240 and Am-241 combined This shows that the external irradiation pathway is about 67 times smaller than the soil ingestion pathway Quantification of the external irradiation pathway is therefore not considered warranted The most significant contributors to risk are being assessed

Any remediation required will assess the ingestion and inhalation pathways for a receptor If risks from these pathways are found to be acceptable, then it can be surmised that risks from the external irradiation pathway will also be acceptable

Comment 3 <u>Page H4-13, Section H.4.4.5.</u> This section, which describes the exposure pathways that will be evaluated for the future construction worker scenario, indicates that ingestion of and dermal contact with subsurface soil and external irradiation from radionuclides in subsurface soil are complete and will be quantitatively assessed This implies that contact with surface soil is not a complete pathway Because of the nature of the exposures, contact with surface soil would be just as likely as subsurface soil exposure and should be considered in the HHRA for the future construction worker Data can be aggregated over the entire soil depth interval evaluated for construction worker exposure (for example, 0 to 10 feet below ground surface)

The future construction worker exposure scenario was developed for the express purpose of assessing subsurface soils since no other exposure scenarios assess this environmental media The future construction worker exposure scenario was developed because all of the other exposure scenarios (i e ,current and future on-site industrial\office worker, future on-site ecological researcher, future on-site open space user and off-site resident) directly assess risks from surface soils This array of exposure scenarios adequately assesses the risks from surficial soil Due to adequate characterization of risks from surficial soils, the construction worker exposure scenario should only be assessed with subsurface soils This position is further enhanced by the fact that COCs were developed and approved for use for surface soils and subsurface soils separately

Comment 4 <u>Page H5-2, First Full Paragraph</u> This paragraph stats that the 95 percent upper confidence limit (95 UCL) of the geometric mean was used as the exposure point concentration for data that were lognormally distributed This is incorrect and may underestimate exposures to those chemicals that were lognormally distributed The 95 UCL of the arithmetic mean should be used as the exposure point concentration for all COCs As stated in EPA guidance (1992a)

> The choice of the arithmetic mean concentration as the appropriate measure for estimating exposure derives from the need to estimate an individual's long-term exposure Most Agency health criteria are based on the long-

term average daily dose, which is simply the sum of all daily doses divided by the total number of days in the averaging period This is the definition of an arithmetic mean The arithmetic mean is appropriate regardless of the pattern of daily exposures over time or the type of statistical distribution that might best describe the sampling data The geometric mean of a set of sampling results, however, bears no logical connection to the cumulative intake that would result from long-term contact with the site contaminants, and it may differ appreciably from - and be much lower than - the arithmetic mean Although the geometric mean is a convenient parameter for describing central tendencies of lognormal distributions, it is not an appropriate basis for estimating the concentration term used in Superfund exposure assessments

Therefore, the 95 UCL of the arithmetic mean should be used as the exposure point concentration even for lognormally distributed data

Additionally, the text indicates that if including the nondetected samples in calculating the exposure point concentration caused the 95 UCL to exceed the maximum detected concentration, the nondetected samples were eliminated from the data set This is not necessary, as the maximum detected concentration of a data set may be used when nondetects cause the 95 UCL to exceed the maximum concentration Furthermore, calculating exposure point concentrations only on detected results may underestimate the exposure point concentration and, therefore, the risks The maximum detected concentration should be used if the 95 UCL exceeds the maximum concentration due to a large number of nondetects with high detection limits (EPA 1989)

This comment also applies to Attachment H1

This referenced paragraph states that "The 95% UCL (Upper Confidence Limit) concentrations were calculated based on either a normal or lognormal distribution, as appropriate " This does not state that the 95% UCL of the geometric mean was used Supplemental Guidance to RAGS, Calculating the Source Term was used to calculate the 95% UCL of the arithmetic mean for lognormally distributed data Tables H5-1 through H5-3 show which COC distributions were lognormally distributed 95% UCL concentrations were calculated per EPA guidance

The practice of eliminating nondetect results with unusually high SQLs if they cause the exposure term to exceed the max detected concentration is consistent with EPA Guidance (EPA 1989a RAGS, section 5 3 2) Even so, depending on the data set, the 95% UCL concentration may exceed the maximum, in which case the maximum is used as the exposure term

Comment 5 Page H5-9, Second Full Paragraph. This paragraph states, "To estimate an RME air concentration, a CT(central tendency) value for VF (volatilization factor) of 0 065 mg/m^3 per mg/L water was multiplied by the RME concentration in groundwater to yield the RME indoor air concentration " It is unclear why a CT value for VF was used instead of an upperbound estimate when determining the RME concentration in air The text should discuss the selection of the CT value for the RME concentration calculation to verify that exposures were not underestimated

The following sentence will be added to the end of the second full paragraph on page H5-9 "A CT value was chosen for the volatilization factor since risks are evaluated for a chronic exposure This CT value would therefore best represent a chronic exposure situation " This volatilization factor applies to a residential scenario which is no longer an applicable on-site exposure scenario

Comment 6 Page H5-10, Paragraph 3. This paragraph states that bis(2-ethylhexyl)phthalate, polychlorinated biphenyls, and chromium were not evaluated in the surface water modeling because they were detected above background in only one or two sampling locations, and their mass flux would be much lower than that of plutonium and americium Organic chemicals should not be compared to background Furthermore, if the chemicals may be transported to surface water, then they should be included in the exposure model, and risks from exposure should be assessed All surface soil and groundwater COCs should be included in modeling fate and transport and in determining exposure point concentrations for COCs that migrate to surface water

Bis(2-ethylhexyl)phthalate (BEHP)was detected in numerous background surface soil samples and a qualitative comparison to background results was presented in section 3 3 of Technical Memorandum #9 Chemicals of Concern, where it is shown that OU2 and background concentrations are similar Never the less BEHP was retained for further evaluation in the risk assessment

The text states that BEHP, PCBs and Chromium were not modeled as surface soil source loads to the creeks due to their relatively insignificant mass flux when compared to Pu-239/240 and Am-241 To assess the validity of this statement, the relative risks from each constituent need to be assessed Table H5-1, "Exposure Point Concentrations of Chemicals of Concern in Surface Soils," shows that the maximum concentrations of all surface soil COCs are in Area of Concern (AOC) No 1 Therefore, relative risks will be examined in AOC No 1 Since the future office worker exposure scenario showed the greatest risk within AOC No 1, the relative risks for this exposure scenario will be examined Since direct ingestion of surficial soils give the greatest risk, the relative risks due to this pathway for an RME exposure will be assessed from Attachment H3 Given these assumptions, the carcinogenic risk for BEHP, PCBs and Chromium combined is 3 59E-07 and the non-carcinogenic hazard index is 6 53E-03 This compares with a carcinogenic risk from Pu-239/240 and Am-241 combined of 6 06E-05

The risks from Pu-239/240 and Am-241 combined are 169 times higher than the risks from BEHP, PCBs and Chromium combined Also, the risks from BEHP, PCBs and Chromium combined are less than the acceptable carcinogenic risk range of 10^{-04} to 10^{-06} and the acceptable non-carcinogenic hazard index of 1 0 Given that the risks from BEHP, PCBs and Chromium are acceptable for the direct ingestion pathway and orders of magnitude lower than the risks from Pu-239/240 and Am-241 combined, it is unwarranted to perform surface water modeling on BEHP, PCB and Chromium BEHP, PCB and Chromium will not be assessed in the surface water modeling

Comment 7 Table H5-3 The exposure point concentrations of groundwater COCs presented in this Table include the "minimum well average" and the "maximum well average" for each chemical These terms should be described in a footnote to clarify how minimum and maximum averages were determined, and whether the 95 UCL was calculated using all data or only data from the "maximum" wells

Because of variability in the number of sampling rounds at different wells, sample results from each well were averaged (arithmetic mean) before calculating the 95% UCL concentrations for each exposure area so that each well is represented equally in the estimate of exposure concentrations This will be outlined in a footnote to Table H5-3

Comment 8 Page H7-2, Last Paragraph. This paragraph states that unadjusted oral toxicity values were used to calculate risks and hazards associated with dermal exposure to COCs The text correctly cites EPA guidance (1992b), stating, "if estimates of the gastrointestinal absorption fraction are available for the compound of interest in the appropriate vehicle, then the oral dose-response factor, unadjusted for absorption, can be converted to an absorbed dose basis " Many gastrointestinal absorption factors are available from toxicity profiles developed by the Agency for Toxic Substances and Disease Registry These sources should be searched before defaulting to the use of an oral toxicity factor for assessing dermal exposures Using unadjusted oral toxicity values can greatly underestimate risks associated with dermal exposures because oral toxicity values are based on administered, rather than absorbed, doses Dermal exposures are estimated in terms of absorbed, rather than administered, doses Toxicity factors based on administered dose (rather than absorbed) underestimate the amount of chemical available to cause a particular adverse health effect When dermal exposures are assessed using the unadjusted toxicity values, risk can be underestimated by a significant amount

Additionally, this discussion states that EPA guidance (1989) recommends against assessing dermal exposure to PAHs EPA guidance (1989) suggests that PAHs be qualitatively evaluated and EPA Region 8 has requested qualitative evaluation of dermal exposure to PAHs at many sites A qualitative evaluation should be provided

It is necessary to assess dermal exposure with respect to the overall risk in the risk assessment to judge whether an adjusted oral toxicity value is needed Oral toxicity values were not adjusted to estimate affects from dermal absorption As discussed in Section H7 1, adjustment of oral toxicity value factors is not considered necessary unless dermal exposure may contribute to unacceptable risk Furthermore, EPA 1992c (Dermal Exposure Assessment) states that "Until more appropriate dose response factors are available, it is recommend that assessors use the oral factors " Because risk from dermal exposure for the office worker in AOC 1 were approximately $2x10^{-6}$ and risks for other receptors were comparably low, no further evaluation of dermal toxicity factors appears warranted, even though the risks from dermal exposure may be somewhat underestimated by this approach We will modify the Uncertainties Section to include this discussion

Risks due to PAH exposure were actually quantitatively evaluated for the direct ingestion pathway in section H10 2 4, "PAHs in Surface Soil " The carcinogenic *risks were 2 3E-06 and 2 9E-06 for AOC No 1 and AOC No 2, respectively The non-carcinogenic risks are 8 6E-05 and 7 8 E-05 for AOC No 1 and AOC No 2, respectively These direct ingestion risks are so low that a qualitative discussion of dermal contact risks from PAHs is not warranted*

Comment 9 Page H7-6, Paragraph 1 This paragraph discusses the derivation of cancer slope factors for nonradionuclides and states, "The EPA acknowledges that actual SFs (slope factors) are likely to be between zero and the estimate provided by the linearized multistage model" (EPA 1989) This statement is misleading and should be rephrased EPA states that the slope factors represent a 95 UCL on the probability of a response per unit intake of a chemical over a lifetime and that there is only a 5 percent chance that the response could be greater than the estimated value based on available data and the model used To state that the actual SF could be zero is misleading, because this would mean that the chemical is not a carcinogen and the associated risk is zero

The sentence stating that slope factors could be zero will be deleted from the text

Comment 10 Page H8-6, Section H8.3.2. This section describes the assessment of risks and indicates that risks from radionuclide exposures were added to those from nonradionuclide exposures This is contrary to EPA guidance (1989) and scientifically untenable for several reasons First, environmental fate and transport models that are used to predict chemical and radionuclide exposures may incorporate different assumptions in the mathematical models These differences may result in incompatibilities in the two risk estimates

Additionally, cancer slope factors for radionuclides and nonradionuclides are developed differently As stated in EPA guidance (1989)

> For both radionuclides and chemicals, cancer toxicity values are obtained by extrapolation from experimental and epidemiological data For radionuclides, however, human epidemiological data form the basis of the extrapolation, while for many chemical carcinogens, laboratory experiments are the primary basis for the extrapolation Another even more fundamental difference between the two is that slope factors for chemical carcinogens generally represent an upper bound or 95th percent confidence limit value, while radionuclide slope factors are best estimate values

Based on these differences, EPA recommends that the two sets of risk estimates be tabulated separately in the final HHRA The risk summary sections should be rewritten to identify radionuclide and nonradionuclide risks separately

We agree that radionuclide exposures and non-radionuclide exposures should be assessed separately Attachment H3, "Health Risk Calculations," actually calculates radionuclide and non-radionuclide risks separately Radionuclide and non-radionuclide risks were added together though in section H8 to reduce the complexity of that section This reduction in complexity was deemed warranted due *to the inclusion of CT and RME risk values The text in section H8 will be augmented to say that radionuclide and non-radionuclide risks can be examined separately in Attachment H3*

Comment 11 Page H10-13, Section H.10.2.3 This section describes the evaluation of vinyl chloride in groundwater Vinyl chloride was identified as a "special-case" COC based on a low frequency of detection but high concentration Risk estimates are presented, which were calculated using the average and minimum detected concentration of vinyl chloride in groundwater The risk calculated using the average concentration is 1E-2, which is extremely high and includes only exposure through groundwater ingestion (not inhalation or dermal absorption pathways) However, the next page states that the "incremental risk from vinyl chloride would not significantly affect the total cancer risk estimate for exposure to groundwater" In fact, the risks from vinyl chloride would at least double the risk associated with groundwater exposure Furthermore, the concentrations of vinyl chloride in water are likely to increase as TCE and PCE degrade Therefore, the risks from vinyl chloride are important and should be calculated using the 95 UCL calculation for all potential exposure pathways for all potential receptors

Vinyl chloride is a special case COC since its concentration is high and its detection frequency was less than 5% Therefore, vinyl chloride was only assessed through the direct ingestion pathway and was assessed separately from other COCs This separate analysis was performed to ascertain the relative risk from vinyl chloride in comparison with other COCs for a residential receptor The risk calculated for vinyl chloride is high, but is approximately equivalent to the risks calculated from other COCs Both of these risks are orders of magnitude greater than 10-04 Therefore, the risks calculated for an on-site resident would be unacceptably high with or without the vinyl chloride results A future on-site residential receptor is no longer applicable at OU 2

Risks from ground water contamination are currently assessed when it daylights to surface water The open space exposure scenario gives the highest risk from exposure to COCs in surface water The carcinogenic risk due to ingestion and dermal contact of surface water are approximately 1E-07 for the open space exposure scenario The inclusion of vinyl chloride into the open space risk should not change the acceptability of the risk from the open space exposure scenario Therefore, vinyl chloride will not be assessed for all potential exposure pathways and all potential receptors

Comment 12 Page H10-14 Last Paragraph This paragraph states that estimated risks to workers from PAH exposure would be 10 times less than those to the on-site resident This contradicts the risk estimates presented, which indicate that risks to residents 3E-6 and risks to workers are 5E-6 The risk estimates indicate that risks to workers are almost twice as high as risks to residential receptors This discrepancy should be corrected

The text contains two errors which will be corrected The risk from soil ingestion for a resident is about five time more than for a worker This value is estimated by comparing soil ingestion risks for the resident and future worker in AOC 1 and AOC 2 as shown in table H8-1 and H8-3 Therefore the risk from ingestion from PAHs in surface soil for the future worker can be estimated as five times lower than 3 x 10-6, *namely 6 x 10^{-7}*

Comment 13 Attachment H3. Table for Hypothetical On-site Resident, 10 acre Maximum Exposure Area, Dermal Contact with Surface Water. This table indicates that future on-site residents will not be exposed to surface water at the site because the surface area used in this assessment is zero It is unclear why this pathway is incomplete because ingestion of surface water for this receptor is evaluated as a complete pathway This discrepancy should be addressed, either both pathways are complete, or both are incomplete

There is no surface water in the 10 acre maximum exposure area, therefore contact with surface water was not evaluated These spreadsheets will be removed from section H3

Appendix J, Quality Assurance

General comments for Appendix J are presented below

GENERAL COMMENTS

1 Appendix J discusses data quality assurance and presents the results for rinsate and trip blank samples Overall this section is acceptable with two exceptions (1) Some data were not considered usable because of elevated levels of detection, no other substantial reason was provided, and (2) trip blank detections were first evaluated against detection limits before applying the 5- and 10-times rule

This comments is addressed in the responses for the following two comments

2 In Appendix J, Section J6 3 1 1, page J-21, the H code is defined as the code identifying metals results which was not used because the order of magnitude was determined to be unreasonably high It further states that "it looked as if a unit conversion was incorrectly made " These metals results should not be eliminated based only on the detected concentration, the concentrations may be elevated as a result of OU 2 activities If a unit conversion was incorrectly made, this mistake should be confirmed and the correct units provided If a unit conversion error cannot be identified, the H-coded results should remain usable, and the elevated results should be evaluated during the screening for PCOCs

The H-coded data was reevaluated to the extent possible to resolve uncertainties associated with the units reported by the laboratory However, it must be recognized that the data in question were collected in 1987, 1989, and 1990, and therefore, it was not possible to conclusively resolve the uncertainties associated with the H-coded data We believe that reasonable grounds exist for disqualifying the H-coded results from use in the PCOC screening process, and that use of unreliable data would be counter-productive to the objective of the screening process Therefore, we recommend that the text be revised to incorporate any additional information obtained and to better explain the rationale for disqualifying the results Additionally, a table of the H-coded data will be added to the RFI?RI Report, but the PCOC screening remains unchanged

3 Only detections of chemicals in trip blanks that exceeded three times the detection limit were used in evaluating if detections in real samples were a result of nonenvironmental contamination (field or laboratory artifacts) The three-times detection limits was applied to trip blanks because it was applied to equipment rinsates per the sampling plan There is no basis for applying the three-times detection limits criterion to trip blanks, applying this criterion may result in real sample detection that are field or laboratory artifacts, as evidenced by trip blank contaminants, erroneously being carried through the PCOC selection process The three-times detection limits criterion should not be applied to trip blanks

To evaluate the potential effects from using the three-times detection limit rule on trip blank data, all the available trip blank data will be reevaluated Based on an initial review, we believe that the use of the three-times rule does not appear to have effected the PCOC selection results

3 0 REFERENCES

EG&G, Inc 1994 Preliminary Draft Phase II RFI/RI Report January

PRC Environmental Management, Inc (PRC) 1994 Technical Review of the Preliminary Draft Phase II RFI/RI Report February 10

U S Department of Energy (DOE) 1994 Technical Memorandum 9, Human Health Risk Assessment 903 Pad, Mound and East Trenches, Operable Unit 2, Rocky Flats Plant Chemicals of Concern, Draft Final

DOE 1995 Final Corrective Measures Study/Feasibility Study Groundwater Flow Modeling Report for Operable Unit 2 June

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